The Philippine Agriculturist and Forester

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EDITORIAL

In celebration of the completion of the small tobacco house of the College, a small exhibition of farm produce was held January 29 last. While this lasted but one day, and was hardly more than a display assembled on the spur of the moment, a considerable number of visitors were attracted and the public comment was altogether favorable. While visitors seemed to be pleased with what they saw of the work of the College, the faculty and students realized so fully that the display had not done approximate justice to the work of the College, even in those fields which shared in the exposition, that the local feeling, as a result of the celebration, was one of by no means pure satisfaction. Voicing apparently the feeling of other visitors, the President urged that, during this College year, an attempt be made to keep an exhibition open for at least two days and to hold visitors, if possible, for a long enough time to permit them to get a real idea of the whole work of the farm, instead of merely seeing such products as in their nature can be assembled for public display.

The near completion of the new agronomy building furnishes an occasion and a place for an exhibition very much more adequate than last year's first attempt. While only a part of the farm work, and an equally small part of the laboratory work, and practically none of the work of various other kinds which demands the energies of the College admits of exposition, the College has had time this year to prepare, so far as this can be done by an exposition, to acquit itself creditably and to give visitors an understanding, instead of a mere glimpse, of its work in certain lines. This exposition will be held December first and second, leaving December third for recovery or the reception of any belated guests. It is planned that December first shall be specifically devoted to the reception of the Legislature and to acquainting the newly elected members of this body

with the institution's functions and achievements. December second is intended rather as a day for the reception of the public at large. Such festivities as naturally accompany the gathering together of many people will find their place. Among these are planned a dance, baseball and basketball games, field day, etc.

This exposition is a day of great importance to the College. We have felt for years that appropriations for our use would be at least trebled if the Legislature understood how well we could use them. In appreciation of the importance of this exposition, and as an aid to visitors in seeing and understanding what is to be exhibited, this number of THE PHILIPPINE AGRICULTURIST AND FORESTER is made a souvenir and guide-book. To avoid any possibility that delay might make it useless for this purpose, we publish it as the October, instead of as the November, number. We believe there is no visitor who will not have a materially improved appreciation of the wealth of Philippine agricultural produce, after going through the exposition, guide-book in hand, and insisting upon the explanation of everything listed in it.

The exposition can show, and is expected to show, the exceedingly varied agricultural produce, which can be harvested at this season, or kept for a number of months in condition to display. It can, and will, give a practical demonstration of many farm, experiment station, and laboratory operations, of practical interest and importance. It can show, both by the demonstrations and by the exhibition of their produce, that the students of this College are educated in a thoroughly practical manner. This exposition is expected to show to the naked eye of the intelligent or unintelligent visitor, so long as he be not blind, that the College has conducted many investigations, and, from these investigations, harvested a large amount of very practically important information which is used, at least locally, for the marked improvement of agricultural work. From the demonstration that a large amount of profitable investigation has been performed at this College, our visitors are expected to understand that the College has natural advantages for such work. From these facts, and the further one, that all such work at this College has been without financial support from the Government for this specific purpose, the visitor is fairly expected to understand that the natural advantages of this College are such that work of this kind can be done here very economically. When our visitors have reached this point in their reflections, we expect them to realize also that the money of the Government may best be spent where it has already been demonstrated that its use will be economical and productive of needed results. No intelligent citizen of the Philippine Islands questions the propriety of appropriation by the Government for agricultural investigation. No visitor who spends enough time at this exposition to understand what is shown will question the proposition that money appropriated for agricultural investigation in the Philippines should be appropriated to the College of Agriculture.

There is much of the work of this College which is not subject to exposition. Beside the produce of other seasons, and the large extent of cultures of long-lived plants, which promise, but have not yet yielded produce, there remains the most important, typical and essential phase of the work of the College—the training of the minds of the student body. We can not effectively show the student in the process of being educated; we can not display

the trained student's brain. Neither can we show the work of the graduates who, after leaving the College, have distinguished themselves on their own farms, as Government employees, or as students in foreign universities. At the most, the exhibition is a display of the minor products of College activity. Its chief products are trained graduates and additions to human knowledge.

FARMERS' CONGRESS

While part of this number of THE PHILIPPINE AGRICULTURIST AND FORESTER was being set up, the Farmers' Congress of 1916 has been meeting in Manila. The attempt to hold this year's congress at an earlier date in Iloilo failed; Iloilo was suffering, at the proposed date, from cholera, to an extent which made it undesirable for a large number of visitors to meet there. Postponement and the necessity of making new arrangements were doubtless responsible for the failure of many farmers to attend the congress in Manila. Nevertheles, about one hundred and fifty members were present, and it has been decidedly the most successful meeting of the kind ever held in the Philippine Islands.

When one recalls the early attempts to hold meetings of this kind in the Philippines, the success of the meetings last year and this is an eloquent testimonial to social as well as to agricultural progress. There was a time when such meetings had to be fostered by the government, when the papers presented were practically confined to expressions of governmental opinion, and reports of governmental investigation, presented for the most part in a language which the visitors were unable to comprehend. The meetings now are held on the initiative of the congress itself; the opinions presented are those of the farmers, and the farmers discuss them thoroughly and with understanding. More of the members use English than did a number of years ago, yet all speakers use Spanish and are understood by all the members. Instead of serving as an opportunity for the government to attempt to instruct the farmers, the last two congresses have been particularly valuable for the suggestions given by the farmers to the government.

In spite of a crowded program, this year's congress adjourned for a day to visit the College of Agriculture, and thereby furnished the College the best opportunity it has ever had to give to a large and appreciative body of visitors an idea of the work it is doing. After the lunch, served in the students' mess hall, several of the visitors gave short talks which were keenly appreciated by the student body. Mr. Sandejas, Chairman of the Committee on Agricultural Education, offered a prize to the best student in the next graduating class from the College, and other members contributed funds for the purchase of instruments for a college band. To these gentlemen, and to Mr. Yangco, who contributed automobiles for the visit, our cordial thanks are tendered.

Before the close of its week of sessions, the congress adopted resolutions appreciative of the work already done at the College, and urging a very material increase in financial support for the institution by the government. We hope particularly that the recommendations of the congress, looking to the establishment at the College on such a basis as the importance of Philippine agriculture would justify, of experimental work in agronomy and animal husbandry, will lead to indorsement and appropiation by the Legislature now in session.

GUIDE TO EXPOSITION

AGRONOMY

In a new country, especially in the tropics, the teaching of Agronomy must go hand in hand with extensive and very practical experimental work. There are very few textbooks in any lines of tropical Agronomy, and most of these are more or less localized in their application. Hence, it has been necessary to develop, at the College of Agriculture, a very extensive experimental farm where special attention is given to the culture of standard crops, such as maize, rice and cane. It remains absolutely necessary, however, to also have in progress cultural work along all of those lines which enter into the College curriculum.

In rice, extensive and very practical work is now under way, covering methods of culture, rotations, fertilization, judging, and selection. This includes both upland and lowland rices. Similar work is under way with maize, the sorghums, cane, many forage crops, sesamum, and other important tropical crops. On the adjoining mountain, a plantation of abacá is being developed which includes many of the important varieties of the Islands, and where students receive first-hand instruction in every phase of the production of Manila hemp. The College maintains coconut plantings of all ages and under various systems of management, in which very complete and thorough practical work is carried on by the students. Coffee plantings of great variety and value for instructional purposes are maintained at the College: 1 hectare at low elevation, 6.5 hectares on the hills, and 1.5 hectares at a considerable elevation on the mountain. Here may be found some 25 varieties of the most promising coffees of the world, together with many selected strains of native coffees, some of the former being quite immune to the notorious coffee rust. The students engage in every practical feature of coffee work from the nursery to the plantation.

Each year tobacco is planted by the students. Thorough training is given in seed-bed work, fertilization, culture, curing, and seed selection. Tobacco experts in Manila had expressed the opinion that fine tobacco could not be grown on the College farm; but the students have produced fine cured leaf that took first prizes at the Philippine Exposition, and produced marketable tobacco for which ₱1.50 to ₱2.00 per kilo was offered in Manila, at a time when fine Isabela was selling at 24 to 30 pesos per quintal of 45 kilos. In this particular case the tobacco happened to be the product of a hybrid between Connecticut Broadleaf and Cagayan, produced in previous years by one of our advanced students. This student work has shown conclusively that fine wrapper tobaccos can be grown in these Islands in any desired quantity. The results in tobacco at the College were obtained in spite of the lack of any special facilities for curing.

Extensive garden work is given to all students in the earlier years of the College course, covering all of the important crops in use in these Islands. The garden work is so divided that every individual student must have experience with all of the crops.

Advanced students are given a thorough course in plant breeding, covering the history and underlying principles of the science, combined with extensive practice in seed selection, test-row work, and hybridization.

As a final test of the student's general fitness and ability to apply his knowledge in some specific piece of highly

practical work, he is assigned, during the last years of his course, to some simple and specific problem in Philippine agriculture, all features of which problem he is obliged to test out thoroughly in the field. The results of this advanced work in "junior research" have already produced many conclusions of the highest possible value in Philippine agriculture. Many of these have appeared in the journal published by the students, and others are due to appear in a short time.

Practical work by the students of this College is already more highly developed than in most of the agricultural colleges of the United States. Outside of actual class hours the student's time is entirely taken up by laboratory and field work. Hired labor on the College farm is purposely kept down to the lowest possible working basis. In these earlier formative years of the College, a considerable amount of hired labor has been necessary in general development work, but at no time has the number of hired laborers exceeded the number that may be seen on the lawns and drives of the small Mehan Gardens, in the city of Manila. The College of Agriculture represents a great public institution—the only Philippine institution of higher learning in this fundamentally important line—and the improvement and beautifying of its campus, a work of great importance, has been accomplished very largely by students. The training received in this work is as important in its way as the field cultural work, since it involves the propagation and handling of many varieties of trees and shrubs, and forms an introduction to orchard work, the development of which is also proceeding at the College.

While farm accounting and blacksmithing, as such, have not yet been given a place in the College curriculum by the University authorities, still, important features of these lines of work already appear quite extensively in various courses covering specific crops. Very complete work is given in the estimation of land and crop values, and operation expenses. The recent work of one of our advanced students, on the cost of producing paddy rice, is one of the most practical and important contributions to this subject ever made in these Islands.

The College is ideally located for the widest possible range of tropical plantings, and fullest advantage is being taken of this fact. Its location as to other important agricultural regions is peculiarly central. On one side, extensive coconut and abaca districts can be easily reached, while on the other, highly developed corn, rice and cane areas are equally accessible. It is also but a short distance from the College to coffee and fruit centers. Fullest advantage is taken of this important feature, parties of students pursuing field studies, and carrying out field experiments at many important points, in closest touch with the actual operations of the Philippine farmer.

The College Farm

Visitors to the College of Agriculture should not imagine that the portion of cultivated area to be observed on entering the grounds comprises all of the College farm. It is, in fact, only a small portion of the farm, and is not used for commercial field cultures. This entire area on the north side of the river is devoted to small cultures and gardens. The small cultures include large series of small plots for trials of various crops being made by the students, and also a large series of preliminary trial and acclimatization plots, where new seeds from abroad, or from other localities, are first carefully tried

out before being used for regular field plantings. In the plots on the north side of the river, seed selection of many important crops, such as legumes, sorghums, etc., will be found in active progress. In fact, a larger part of the cultures on this side of the river represent carefully selected, pedigreed strains. Here, also, will be found the garden plots, where every student receives training in garden management.

On the other side of the river, to the east of the College barrio, will be found the commercial field cultures. These include extensive plantings of maize, rice, sugar cane, root crops, bananas, etc. The citrus planting now includes some fifty varieties, while of the bananas there are several hundred distinct kinds. Especially worthy of note is the rapid growth and fine condition of the bananas, due to proper methods of planting and cultivation.

On the mountain, back of the College, we have installed plantations of coffee, abaca, and miscellaneous forest fruits. These now include some 15,000 plants.

Rice

Oryza sativa

Shown by Mr. Marquez

Filipinos get the lowest average yields per unit of area of any rice farmers in the world. Philippine yields can easily be doubled or tripled by use of rigidly selected and carefully bred seed. Results on the College farm have also shown that there are very considerable profits possible in the use of ordinary natural fertilizers, such as manure and ash. All of the rices exhibited are now in active process of selection, this work being done by students.

Upland Rice

4466 Nadami
4467 Mantika Pilit
4468 Catalong
4476 Bonguet
4478 Binicol
4489 Sacsec
4490 Kalibod
4491 Binagontao
4492 Sinacoban
4493 Binundo
4494 Sanglay Puti
4495 Kinastila II
4496 Maliro
4497 Putyucanon
4498 Kinastañong Balbasin
6036 Sinampaga
6037 Kinanda Pula
6038 Pinursigue
6039 Kinamalig
6040 Kinagaykay
6041 Guluya

Paddy Rice

5891 Binicol
5892 Binambang
5893 Ganado
5894 Iroy
5895 Binalayang
5896 Bulilising
6188 Puti rabon
6189 Pula rabon
6190 Escorro
6191 Calaua
6192 Calubag
6193 Inaguio

Maize

Zea Mays

Shown by Mr. Elayda

Active work is under way on the College farm in the improvement of our native corns by selection, fertilization and modern methods of culture. This year we have carried through an interesting piece of work in the comparison of plantings made side by side from seed obtained in many widely separated parts of the Philippines, and special attention is called to the exhibit of the results of this planting.

357 Mestizo White Dent
4434 Los Baños Yellow Flint
5417 Lipa Yellow Flint

5861 Moro Corn
5916 Mindoro Yellow Flint
5918 Batangas Yellow Flint
5919 Cavite Yellow Flint
5920 Tayabas Yellow Flint
5921 Los Baños Yellow Flint
5922 Aliaga Yellow Flint
5923 Bulacan Yellow Flint
5924 Zambales Yellow Flint
5925 Antique Yellow Flint
5926 Iloilo Yellow Flint

Sorghums

Sorghum vulgare

Shown by Mr. Elayda

Many varieties of sorghums and broom corns have shown themselves to be perfectly adapted to Philippine conditions for both wet and dry seasons. Some of these varieties are very valuable for their grain, others furnish large amount of forage, while still others furnish valuable stock for the manufacture of brooms and brushes.

693 Red Kaffir Corn
1681 Black Amber Sorghum
2231 Red Albay Sorghum
2872 Black Amber Sorghum
2875 Early Amber Sorghum
3023 Improved Dwarf Broom Corn
3025 California Golden Broom Corn
3028 Dwarf Broom Corn
3030 Early Amber Sorghum
3414 Early Amber Sorghum
3415 Kaffir Corn
3416 White Egyptian Milo Maize
3417 Milo Maize
5436 Minnesota Amber Sorghum
5440 Black Amber Sorghum
5442 Planter Sorghum
5446 Black Amber Sorghum
5447 Red Durra
5449 Black Amber Sorghum
5455 Red Durra
5458 Early Amber Sorghum
5463 Black Amber Sorghum
5466 Planter Sorghum
5468 Black Amber Sorghum
5477 Chinese Sorghum

Forage Plants

Shown by Mr. Elayda

The subject of forage is an extremely important one in the Philippines and work on this subject has been in progress, under the direction of Mr. Elayda, for the past four years. On the College farm, we have had exceptionally good results with guinea grass, Japanese cane, cowpeas and Rhodes' grass. A complete work on this subject has been presented by Mr. Elayda as a thesis for the degree of Master of Science.

203 *Panicum maximum*, Guinea Grass
637 *Paspalum dilatatum*, Water Grass
737 *Vigna sinensis*, Cowpea
3451 *Saccharum officinarum*, Japanese cane
4414 *Panicum molle*, Para Grass
4415 *Chloris gayana*, Rhodes Grass

Sugar Cane

Saccharum officinarum

Shown by Mr. Mirasol

Due to the importance of the sugar industry in the Philippines, the College has made every effort to develop adequate work in the practical testing of many of the best local and foreign varieties of cane. Methods of culture, including studies of the relation of spacing, fertilization, and cultivation to production are constantly in active progress. The importance of this work can be realized when it is known that the average production per unit of area in the Philippines is not one-fifth that of the best sugar-producing countries.

Cavite varieties:

4834 Momuñgan, Mindanao
1834 Sinandoyong, Malolos, Bulacan
1835 Zambales White, Malolos, Bulacan

1836 Los Baños White, Los Baños, Laguna
3456 Sinandoyong, Calawang, Laguna
2938 Caña Morada, Silay, Occidental Negros
5513 White Cane, Muntinlupa, Rizal
5514 Purple Cane, Muntinlupa, Rizal
5515 Soft White Cane, Iloilo
5516 Soft Red Cane, Iloilo
5517 Cabilawan, Iloilo
5518 Hard Red Cane, Iloilo
5519 Hard White Cane, Iloilo

Foreign varieties:

5497 Japanese Cane—Purple, through the Bureau of Agriculture
3451 Japanese Cane—White, through the Bureau of Agriculture
5576 Yellow Caledonia—Hawaii, through Calamba Sugar Estate
5583 Louisiana Striped—Lousiania, through Calamba Sugar Estate
5575 Lahaina, Hawaii, through Calamba Sugar Estate
5577 D.95, Demerara, through Calamba Sugar Estate
5568 H.16, Hawaii, through Calamba Sugar Estate
5569 H.20, Hawaii, through Calamba Sugar Estate
5570 H.27, Hawaii, through Calamba Sugar Estate
5571 H.69, Hawaii, through Calamba Sugar Estate
5572 H.220, Hawaii, through Calamba Sugar Estate
5573 H.227, Hawaii, through Calamba Sugar Estate
5574 H.309, Hawaii, through Calamba Sugar Estate

Camotes

Ipomoea batatas

Shown by Mr. Medalla

A number of very important studies on camotes have been carried out by students of College of Agriculture. The College has maintained in culture, at all times, a large series of the best varieties of camotes. Several hundred thousand cuttings from the best of these have been distributed throughout the country, and cuttings are always available to anyone wishing to obtain them.

335 White Boco-boco
337 Iningcanto
345 Red Boco-boco
336 Amorosa
350 Maragandan
333 Samar Big Yellow
344 Magallanes

Yautias, Gabis and Dasheens

Shown by Mr. Ocfemia

The gabi is one of the standard native vegetables in the Philippines. We have introduced, acclimatized and distributed many strains of the similar yautias from the American tropics, which are as good, or better, for eating; are stronger and more productive, and are not subject to one of the most destructive diseases of the gabi.

Xanthosoma sagittifolium, Yautias

309 Rolliza blanca Yautia
430 Malanga blanca
434 White Tamma Yautia
436 Punyera Yautia
438 Banana Tatin Yautia
439 Trinidad Yellow Yautia
440 Prieta or Morada Yautia
441 Mi Señora Yautia
442 Royal Taro
443 Grey Jack Yautia
444 Rolliza Yautia
584 Yautia
589 Yautia
1521 San Fernando Po Yautia
587 Yautia
588 Yautia
1720 Yautia

Colocasia antiquorum, Gabis and Dasheens

308 Los Baños Dasheen
1055 Siniñora Gabi
1056 Manalod Red Gabi
5767 Bongcocan Gabi
5770 Gabi, Albay
5771 Gabi, Albay
5772 Gabi, Albay
5773 Gabi, Albay
5774 Gabi, Albay
5775 Gabi, Albay
5776 Gabi, Albay
5777 Gabi, Albay
5778 Gabi, Albay
5779 Gabi, Albay
5780 Gabi, Albay

Yáms, Ubis and Tugues

Dioscorea

Shown by Mr. Santos

A very large number of varieties of yams, ubis and tugues are to be found in the Philippines. We have gathered together many of these varieties for careful testing, with the object of selecting the best for further improvement.

88 I. *Dioscorea aculeata* var. *tiliaefolia*, Small Tugue
88 II. *Dioscorea aculeata* var. *tiliaefolia*, Large Tugue
3331 *Dioscorea hirsuta*, Calut or Nami
938 *Dioscorea alata*, Ubi
942 *Dioscorea* sp., Tugue
954 *Dioscorea* sp., Tinugue
957 *Dioscorea* sp., Tabayan
959 *Dioscorea* sp., Kinahoy na pute
960 *Dioscorea* sp., Dinaliri
1369 *Dioscorea* sp., Ubing Ligao

Arrowroot

Maranta arundinacea

Shown by Mr. Vista

I. Fresh tubers
II. Starch
III. Boiled tubers

Cassava, or Camoting Cahoy

Manihot utilissima

Shown by Mr. Vista

There is no article of commerce which, under its own name, or concealed by another, is in more universal demand than starch. As a human food, for laundry purposes, for use in cotton mills and for paste, it sells everywhere under the name of starch; but vastly larger quantities are sold under the name of flour, of which starch is the chief constituent. Of all commercial starches, corn is the cheapest in price, but cassava starch is the most cheaply produced. From these facts, it follows that while corn starch must be produced at a profit, or its price would rise, cassava starch will pay a much greater profit to the producer. In the Philippines, proper climatic conditions are combined with the presence of the most productive known varieties of this plant. Whenever an earnest attempt is made to develop starch as an export product, it will probably be but a short time before the preeminence of abacá and sugar are threatened by it.

The cassava exhibits are:—

I. Fresh tubers attached to stump
II. Cassava flour
III. Cassava starch
IV. Boiled tubers
V. Varieties:
638 I. Rough intermediate cassava
638 II. White smooth cassava
644 Kapo White, or Green Cassava
645 Kapo Colorado, or Red Cassava
6222 Angular Cassava
3896 Mandioca sao Pedro treto
3897 Sipin Mangi
3898 Mandioca Basiorao
2399 Casjave Singkong manis
3900 Sipin Valenca

Legumes

The legumes as a class are not only of very high importance as food products

both for men and domesticated animals, but they form a most highly important part of the most rational systems of crop rotation. Their influence in the renovation and restoration of poor or depleted soils is now fully recognized in all the most progressive countries on earth. A great deal of work in connection with legumes is constantly being done by the students of the College.

LEGUMES FOR GREEN MANURE ONLY

Shown by Mr. Ocfemia

496 *Stizolobium Lyoni*, White Velvet Bean

5501 *Tephrosia candida*
5502 *Tephrosia sumatrana*
5508 *Tephrosia Hookerania*
5503 *Crotalaria striata*
5504 *Crotalaria Muijussi*
5507 *Crotalaria incana*
5505 *Indigofera hirsuta*
5510 *Indigofera suffruticosa*
} from Java

5809 *Canavalia ensiformis*, Horse Bean

FIELD BEANS

Phaseolus vulgaris

Shown by Mr. Ocfemia

2108 Runner Bean
2126 Stringless Sugar Bush Bean
2137 Wacho Dotte Bush Bean
2157 Earliest Brown Sugar Bush Bean
4945 Tepary Bean

FLAT BEANS—LIMAS

Phaseolus lunatus

Shown by Mr. Ocfemia

2664 Balungcat
3394 King of the Garden Lima
3407 Henderson Bush Lima
5806 Spotted Gray Patani
5807 Red Patani
5814 Brown Patani
5817 White Spotted Patani

Dolichos Lablab

2651 Zambales White Batao
5946 Los Baños Batao
5948 Makham Sem
3649 Red Pod Batao

GENERAL UTILITY FIELD LEGUMES

Shown by Mr. Ocfemia

Cowpeas

737 *Vigna sinensis*, New Era Cowpea
514 *Vigna Catjang*, Sitao

Mongos and Grams

213 *Phaseolus calcaratus*, Sinay
406 *Phaseolus Mungo*, Looktao Mungo
523 *Phaseolus aureus*, Green Gram
4394 *Phaseolus Mungo*, Green Mungo
4780 *Phaseolus Mungo*, Black Mungo

MISCELLANEOUS FIELD LEGUMES

Shown by Mr. Ocfemia

2123 *Dolichos sesquipedalis*, Asparagus Bean
2073 *Pisum sativum*, Sugar Pea
3073 *Pachyrrhizus erosus*, Sincamas
207 *Psophocarpus tetragonolobus*, Calamismis
620 *Voandezia subterranea*, African Earth Nut
610 *Cyamopsis psoraleoides*, Solia Guar
5808 *Cajanus indicus*, Brown Caguios
5812 *Cajanus indicus*, White Caguios
5818 *Cajanus indicus*, White Spotted Caguios

SOY

Shown by Mr. Grageda

Soy beans are imported into the Philippines in very large quantities, for the manufacture of certain important food products, such as soy-bean curd. A single ship was recently said to have brought to the Philippines a cargo of six thousand tons of these beans. The question is often asked as to whether these beans could not be grown in the Philippine Islands. Work extending through several years at the College has answered this question very conclusively. We have found that there are certain strains well adapted to our

dry season and certain other strains equally well adapted to the wet season. These beans contain fifteen to twenty percent of oil. Their growth greatly benefits the soil through the power of the plant to gather nitrogen from the air; and this value for green manure only, on the basis of the market price of nitrogen, has been estimated in the United States at $20 gold per acre.

217 *Glycine hispida*, Ami's Bean
3905 *Glycine hispida*, Javan Kedilcie Wit

Peanuts

Arachis hypogaea

Shown by Mr. Silayan

Peanuts, or *mani*, as they are commonly called here, are universally planted in small amounts throughout the Islands, but the stock used is commonly very inferior. We have at the College numbers of the best varieties of the world, and some of these have given good yields under our conditions. Seeds of most of these varieties are available for distribution.

I. Dried nuts and shelled seed
- 109 American
- 2703 Indian
- 3077 Spanish U. S. A.
- 3078 Spanish Indian
- 3082 Lemery
- 3083 Kinorales
- 3084 Chinese
- 3166 Spanish C. A.
- 5957 Montalban
- 5958 San Mateo

II. Oil and peanut products

Horticulture

Shown by Mr. Cocannouer, with the Help of Many Students

The horticultural exhibit consists of demonstrations of various kinds in the gardens and nursery, and a display of produce in the agronomy building. The following outline shows briefly the plan of this exhibit:

(A) Olericulture
1. Field demonstrations
   (a) leaf crops, with and without fertilizers
   (b) root crops, with and without fertilizers
   (c) Solanums, with and without fertilizers
   (d) sweet corn, with and without fertilizers
   (e) special relishes, with and without fertilizers
2. A model market garden
3. Exhibition of garden crops grouped as shown above, in the agronomy building

(B) Nursery Demonstrations
   (a) Demonstration of proper methods of preparing seed flat soils
   (b) Proper soils for cuttage work and best methods of growing plants from cuttings
   (c) Demonstrations of the use of the "Kier's" layering rack
   (d) Display of potted orchard plants

(D) Floriculture:
1. Display of native wild ornamentals
2. Display of native cultivated ornamentals
3. Display of foreign flowering plants
4. Display of *coleus* hybrids produced by Mr. Lipayon

Fruits

Shown by Mr. Medalla and Mr. Quisumbing

Extensive studies of fruits have been made at the College with the special purpose of testing out important seedling forms, and also of locating through-

out the country the few trees of extraordinary value which may serve as bud stock in connection with nursery work, which is gradually being developed at the College. The collection of bananas in the College plantation, which has been assembled for the purpose of making careful tests and comparisons, is not only the largest collection of the sort in the Orient, but probably the largest in the tropics of the world, since it now includes some five hundred varieties.

1. Citrus fruits

Citrus nobilis, Naranjita or Tangerine

Citrus decumana, Lucban or Pomelo

Citrus papillaris, Tizon

Citrus mitis, Calamondin

Citrus lima, Dayap or Lime (Luzon)

Citrus lima, Sua-iclog (Mindanao)

Citrus medica, Citron

Citrus torosa, Colobot

Citrus hystrix, Cabuyao

Citrus sp., Sigaras

Citrus micrantha, Biasong (Mindanao)

Citrus sp., Bulurkot (5969, Mindanao)

Citrus sp., Susanabay (5967, Mindanao)

Citrus sp., Pamutalan (5968, Mindanao)

II. Miscellaneous fruits

Achras Sapota, Chico or Sapodilla

Annona muricata, Guanabano

Anacardium occidentale, Casoy or Cashew

Artocarpus integrifolia, Nanka or Jack Fruit

Carica Papaya, Papaya

Dillenia philippiniensis, Small Catmon

Dillenia grandiflora, Large Catmon

Ficus ulmifolia, Wild Fig

Hedyachras philippiniensis, Socomo

III. Bananas and Plantains

5069 Canipa
5181 Hum Chuntara
5056 Maduranga—India
5203 Yan Vat Ching
5156 Choi Mak
5013 Matabia
5092 Yala Ulu
5104 Bugtong
5035 Ramkela "Green"—India
5256 Chuoi Ticu Huong
5381 Kanher
5102 Valeria—Saigon
5245 Tarua
5403 Homchan
5396 Krie
5386 Ganaga
5391 Huk Mook
5043 Kinayagan
5266 Languma
5149 Sungay Baca
5222 Tandon
5036 Saba Iloco
5066 Carandan
5252 Fique Blanche
5034 Martaban Dacca—India
5124 Saba Mariano—(Mari cuna)
4537 Banana "Wild"
303 Dwarf Hawaiian
5144 Pinagbilinan
305 Bongolan—Los Baños
1111 Darayao—Tanauan, Leyte
930 Inarnibal—Nagcarlang, Laguna
2796 Puteng cohol—Calawang, Laguna
2800 Ternate—Los Baños
1116 Tudlong Dato—Tanauan, Leyte
900 Veintecohol—Morong, Rizal
2794 Binendito—San Pablo, Laguna
6343 Cuban Red
884 Durugo—Rizal Province
5399 Klum
306 Morado—Los Baños
5223 Pop
1117 Tundok

5380 Yanaikonban
1112 Binutig
1123 Garangao
1375 Hanatuco
5388 Kanari
Lacatan
5228 Lampoeng
301 Pitogo
5084 Caala Kling—Sarawak, Borneo
5103 Chuoi La—Saigon
5020 Dulol
5074 Edaan
4972 Hazara
5192 Namthai
5353 Padilat
5109 Puttean
4974 *Musa Martini*
4984 Dool
1114 Pinaraca
5015 Inabaniko
5365 Butuhan
5001 Letondal
6344 Saguing maching

Preserved Fruits and Vegetables
Shown by Mr. Marquez

The storage of food products is a matter of great importance in the Philippines. The present exhibit prepared by students shows some of the possibilities in this direction. Complete instruction in this line of work should be developed in all the schools of the Islands.

1 Tomato..... jelly
2 Bignay..... "
3 Guava..... "
4 Ubi..... "
5 Coconut..... "
6 Catmon..... "
7 Camias..... "
8 Bananas..... "
9 Condol..... "
10 Santol.....preserves
11 Lucban..... "
12 Coconut..... "
13 Pineapple..... "
14 Chico.....preserves
15 Lanson..... "
16 Catmon..... "
17 Caong (Cabo-negro).... "
18 Orange..... "
19 Condol..... "
20 Ginger..... "
21 Spiced Socomo.....butter
22 Guanabano.....preserves
23 Spiced papaya.....butter
24 Ginger squash.....
25 Banana figs.....
26 Nata-de-piña.....
27 Guava.....preserves
28 Coconut candy.....
29 Dried papaya.....
30 Tamarind marmalade..
31 Green tamarind jam...
32 Papaya jam.....
33 Banana jam.....
34 Camias Pickles.....
35 Sweet Pickled Condol..
36 Mixed Pickles.....

Plants Yielding Essential Oils
Shown by Mr. Macasaet

Only one of the plants under this head is of considerable commercial importance in the Philippines, this being *Cananga odorata* (Ilang-ilang). It will, however, be noted that a number of plants yielding important essential oils can easily be produced in the Philippines, as shown by existing cultures at the College of Agriculture.

I. Living material
Cinnamomum Mercadoi, Calingag
Cinnamomum Camphora, Camphor
Melaleuca Leucadendron, Cajaput
Eucalyptus
Pimenta acris, Bay Rum
Cananga odorata, Ilang-ilang
Michelia Champaca, Champaca
Viola chilensis, Violet

II. Oils
Cajaput
Ilang-ilang

Sesamum Indicum

Shown by the Agronomy V Class

Liñga is grown in small amounts in all parts of the Islands and is considered a luxury, being used in making sweetmeats. In some other countries, it is a standard crop, being raised in immense quantities for its oil, of which it carries a large percentage. The common stock liñga in culture in the Philippines is ordinarily poor, and very heterogeneous in character. Our students have been very successful in separating out distinct strains by selection, and in propagating these, with the result that gains of twenty to fifty percent, over ordinary yields, have been obtained in our cultures.

1622 ..... White Liñga
1622 F_2 ..... " "
1622 F_3 ..... " "
412 F_3 ..... " "
403 F_3 ..... Black Liñga

Tobacco

Shown by the Agronomy III Class

Tobacco work at the College has resulted in the separation by selection of a considerable series of tobaccos which give good results at this place. Several of these tobaccos, under special methods of culture and of curing, have yielded fine wrapper tobacco which brought bids of ₱1.50 to ₱2.00 per kilo in Manila. A new hybrid—the *Tirona*—was produced at the College by one of our students, and this shows special promise as a first-class wrapper tobacco. All students taking Agronomy III are given extensive practice in every phase of tobacco culture.

I. Seed-bed methods
II. Growing crops
III. Fertilizer experiments
IV. Cured leaf, cigars, and cigarette tobacco

1. Tirona Hybrid
2. Vuelta Abajo
3. Connecticut Havana
4. Texas Cuban

Coffee

Shown by Mr. Luistro

The subject of coffee in the Philippines is, at this time, characterized by a lack of very necessary information and a lack of exact data, and the College has taken very active steps towards the development of this subject to enable it to give the necessary instruction and advice to its students. It has established the most extensive experimental plantings of coffee in the Philippines, comprising one hectare at a low altitude, six and one-half hectares at an intermediate altitude and one and one-half hectares at a higher altitude. These plantings include some fifteen varieties of the best known coffees of the world, and a considerable series of selections made from desirable native plants, which have resisted the prevalent and destructive coffee rust.

I. Seedlings of the best known coffees of the world.

5484 Uganda	20	seedlings	8	months old.
5485 Quillou	20	"	9	" "
5486 Robusta	20	"	7	" "
5487 Robusta	20	"	7	" "
5488 Congensis	20	"	8½	" "
5489 Robusta	20	"	7	" "
5490 Uganda	20	"	8	" "
5491 Excelsa	20	"	7	" "
5492 Robusta	20	"	8	" "
5493 Canephora	20	"	8	" "
5494 Madagascariensis	20	"	7	" "
5495 Robusta	20	"	7	" "
5496 Robusta	20	"	7½	" "
5581 Robusta	20	"	6	" "
5596 Los Baños Arabica	20	"	6½	" "
5597 Los Baños Arabica	20	"	6½	" "
5843 Lepanto	20	"	3	" "
5858 Lipa Liberica	20	"	3	" "

The above strains came from selected trees.

II. Two plants (3½ years old) of *Caracolillo* in pots. One was sprayed

with Bordeaux mixture. Planted at the same time under very similar conditions.

III. Samples of parchment coffee, harvested from 2½ year Malaybalay trees grown by the College. All trees were found infected with *Hemileia vastatrix*. Each bottle represents the production of one individual tree.

IV. Samples of parchment coffee, harvested from 2½ year *Caracolillo* trees grown by the College. All trees were found infected with *Hemileia vastatrix*. Each bottle represents the production of one individual tree.

V. Samples of parchment coffee, harvested from sprayed trees of *Caracolillo* (3½ years old) and bottles of parchment coffee, harvested from trees of the same variety, but not sprayed. Each bottle represents the production of one individual tree.

VI. Samples of parchment coffee, harvested from sprayed trees of old native coffee grown by the farmers around the College.

Samples of parchment coffee, harvested from same type of trees, but not sprayed.

VII. List of varieties of coffee in culture at the College of Agriculture.

VIII. Two boxes for seed-bed, showing the germinating coffee seeds.

Cacao

Theobroma Cacao

Shown by Mr. Luistro

In the present exposition is shown a series of yields of individual trees, as these are grown at their best by farmers in the vicinity of the College. The College has undertaken an extensive series of selections from the best Philippine cacaos, and is establishing plantations based upon these selections. We have also taken steps to secure some of the best foreign cacaos.

I. Cacao seedlings which were given different treatment in the seed-beds.

II. Cacao seed-bed boxes showing the different ways of germinating cacao seeds.

III. Individual production of cacao trees grown by the native farmers around the College.

Coconut Products

Cocos nucifera

Shown by Mr. Vista and the Agronomy II Class

If one may judge from the condition of the districts where it is the staple crop, the coconut is easily the most desirable crop for the Philippine Islands. Sugar in some places, abacá in others, tobacco in still others, rice and garden crops almost everywhere, may pay better rates for the use of land, but the presence of the coconut, as the staple crop, is the index of general prosperity. The coconut districts never knew famine and do not know real poverty. It is only in coconut districts that labor is always scarce, and even the rich man has trouble in finding servants.

From the establishment of this College, problems of coconut culture have received foremost attention. When the College farm was bought, it contained three coconut groves, all in indifferent or poor condition. One of these, with only about one hundred trees, was not wanted, and was hopelessly infested by beetles. The other two have served as a laboratory for the study of its pests and of the coconut itself. Beside these two groves, within sight of the agronomy building, the College has about two hectares of young coconuts near the back of the farm, and a considerable number of trees of different varieties planted along the north boundary, separate from other groves, in order that the varieties may be bred pure

if they prove worth it. The exhibit of coconuts and coconut produce in the agronomy building is as follows:

1. Comparison of yield
   (a) 1 bunch of young coconuts from productive tree
   (b) 3 or more bunches of young coconuts from less productive trees
2. One ten-liter bottle full of vinegar
3. About two liters of fresh toddy
4. Baskets made from veins of young leaves (5 baskets)
5. Brooms made from veins of old leaves (5 brooms)
6. Brooms made of (young) main axis of fruit branch (5 brooms)
7. Copra:
   (a) Hot-air dried copra
   (b) Smoked copra
8. Coir—5 kilos
9. Lumber—about 2 pieces of 1½ meters each
10. Dried spathe coverings,—for torch (5 torches)
11. Coconut shells made into cups (12 cups)
12. Young leaves made into decoration
13. Young and old spathes showing when the spathes are ready for cutting for toddy.
14. Newly opened spathes showing the bunches containing "baby" flowers that develop into nuts
15. Tobacco wrappers—woven leaves for wrapping tobacco
16. One coconut twin
17. Five one-and-a-half-month old seedlings
18. Five one-year old seedlings

Away from the agronomy building are exhibits No. 19, an experiment by the Agronomy II Class to show the rate of loss of water from coconut leaves; and 20, the operation of an imported copra drier. This copra drier is not suited for plantation work, being too small to be operated economically. It produces excellent copra and a more capacious drier of the same kind might be very efficient.

19. Transpiration experiment by Agronomy II Class
20. The operation of copra drier

Fibers

Shown by Mr. V. C. Aldaba

Among the exports of the Philippines, the first in importance in every series of years, and in almost every single year, is the fiber product, abacá, or Manila hemp. This Philippine product has a practical monopoly of the world's market for fiber of this general kind. For this reason, prices are usually high and there is a fairly steady demand, which in the past has suffered but moderately from the production of qualities which were poor, because of carelessness or ignorance of proper methods. Very recently, another group of fibers, produced by maguey and sisal, have assumed a place of some importance among the Philippine exports, and at the same time fibers of this class produced in Java and Africa have made themselves felt as competitors of abacá. Fiber seems likely to remain a foremost Philippine export crop. At the same time that abacá fiber holds this position, other fibers have a very prominent place among our imports. It is doubtful if the most important of these, cotton, can be produced here on a large scale and profitably. Silk can be produced here; and so can various fibers which would obviate the importation of jute and other fiber of the same general quality.

Bast Fibers

Untwisted Fibers:

Labayo (*Melochia umbellata*)
Sipit Ulang (*Malachra fasciata*)

Roselle (*Hibiscus Sabdariffa*)
Culut-culutan (*Triumfetta bartramia*)
Anilao (*Columbia serratifolia*)
Danling (*Grewia multiflora*)
Tanag (*Kleinhovia hospita*)
Culutculutan (*Urena lobata*)
Anabo (*Abroma angusta*)
Ramie (*Boehmeria nivea*)

Cords:

Columbia serratifolia
Grewia multiflora
Melochia umbellata

Fiber Plants:

Melochia umbellata
Malachra fasciata
Malachra capitata
Hibiscus Sabdariffa
Triumfetta bartramia
Columbia serratifolia
Grewia multiflora
Kleinhovia hospita (shoots)
Urena lobata
Abroma angusta
Boehmeria nivea
Gossypium sp. (cotton)
Bombax malabarica (silk cotton tree)
Ceiba pentandra (kapoc)

Abaca

Untwisted Fibers:
Extracted by Agronomy II students
Abacá varieties
Fiber from one stalk each
Laguna variety
Grown in open with some care
Grown in open without any care
Grown in partial shade
Grown in dense shade
From edge of sheath, and from middle
Fiber of four other varieties
Cells under microscope

Miscellaneous Fibers

Saba banana
Mauritius hemp (*Furcraea* sp.)
Extracted by retting
Extracted without retting
Maguey (*Agave Cantala*)
Sisal (*Agave rigida sisalana*)
Bowstring Hemp (*Sansevieria zeylanica*)
Cabo negro (*Arenga saccharifera*)
Kapoc (*Ceiba pentandra*)

Animal Husbandry

Two main courses are given in this Department. The first course is required of all our students and takes the form of instruction in the relation of type to usefulness mainly. Score-card work, comparison, and competitive judging are given on the Philippine pony, the carabao, "vaca" or ox, and hogs. Beef and dairy cattle and goats are also studied as to their possible value in the Islands. Lectures and demonstrations, when material is available, are given on the commoner diseases of animals, preventive measures, disinfection, and methods of control of epizootics. Methods of restraint of animals for the treatment of lameness, and minor surgical operations, such as castration and the dressing of wounds, are also taught. Exercises are also given in the butchering of cattle and hogs, and the dressing and cutting of carcasses according to the most approved methods, as well as the curing and preservation of meats for farm consumption. A share of the year is devoted entirely to poultry.

The second year course is a more detailed course in feeding, breeding and diseases.

The exhibits and demonstrations listed below are presented to convey a concrete idea of the scope of the work given.

1. **Incubator with Chicken Hatching.**—The incubator is a sort of a box with heating and ventilating arrangements and made to imitate the hen as closely as possible. Incubator-hatched chicks are free from lice and mites and other vermin, which those naturally incubated get from their mother. It enables the hens to continue laying after a reasonable time of rest, instead of losing their time sitting and brooding chicks, and not producing eggs in the meanwhile. Where poultry raising is carried on extensively, the incubator is an indispensable part of the equipment. It enables the caretaker to handle more eggs at any one time and extends the possibilities of poultry production beyond the limits that can ever be dreamed of with natural incubation.

2. **Market Eggs.**—The quality of eggs determines their market price. Eggs of uniform size and color are more pleasing to the eyes of the consumer and are therefore in greater demand. We are trying to improve the size of the egg and the production of the native hen by breeding it with improved breeds which lay many and big eggs. Compare the size of the mestizo eggs with that of the native ones.

3. **Crate of Fattened Chickens.**—Poultry used on the table would be more wholesome and palatable if, instead of being taken straight from the range, they were cooped up and fed for a week or so on some rich and easily digested feed. The flavor is thus improved, for fat is deposited between the muscle fibers, which tends to make them cook individually when the dish is prepared, making the flesh tender and juicy. The chickens are starved for a day or so and then confined for about ten days to two weeks, while they are given easily digested food in the form of a mash, three times a day, and as much as they will eat. The ration used with these birds is 6 parts of cornmeal, 2 parts of crushed rice, 2 parts of rice bran, and 1 part of copra meal. This is moistened with molasses and water to the consistency of plaster. No water is given them.

4. **Chicks of Various Breeds.**—These represent the result of our efforts to acclimatize improved breeds of other countries to our own. It may take many generations before we may be

able to make them really at home, but we expect to raise them here sometime.

5. **Select Pens of Native and Grade Chickens.**—These are from our own flocks and are the product of a study of one of our students, in crossing the native chicken with the improved breeds, to find out possible ways of improvement. The Black Orpington mestizos are proving to be better layers than the native stock.

6. **Types of Vacas.**—The capacity of an animal for work may be judged from its conformation. A heavy and low-set animal is a slow mover, but it is strong and can perform heavy work, such as plowing and hauling heavy loads. Leggy animals are much faster, but are only fitted for light work. A few other points in the selection of a good farm animal are capacity for feed, endurance, and the development of the parts where work is centered. The students are taught to examine every part of the animal and determine its usefulness as a whole.

7. **Preserved Meats.**—Large quantities of preserved meat are consumed in the Islands, most of which is imported. In remote towns or barrios where animals are not slaughtered regularly meat is very expensive and the supply very uncertain. A farmer who can preserve his own meat can live more economically.

8. **Improvement of Native Stock Through Breeding.**—A great number of our animals can be improved readily by making use of the results obtained in other countries. Look at our "mestizo" hogs; they look better than their scrub parent and almost as good as their improved parent.

9. **Caponizing.**—This improves the quality of the meat of the male chicken. One always has more roosters than he can use (we overlook the gambler) and if they are allowed to mature uncastrated, their meat becomes hard and stringy and unfit for table use.

10. **Throwing a Bullock.**—Very often a work animal gets injured on the toe and the only way it can be treated is to throw the animal down. With the aid of a single rope two persons can throw the strongest bull easily.

11. **Throwing a Horse.**—Injury of the leg may require painful treatment which is possible only by throwing the horse down. Also, a horse can be castrated more easily while thrown.

12. **Butchering Cattle.**—It is easy enough to find somebody who knows how to butcher a hog but often an ox needs to be killed on the farm and nobody is available. Our students get training in butchering farm animals so that they can do their own butchering, save the fee of a hired man, and do the work better and to their own satisfaction.

13. **Milk Testing.**—The most important component of milk, and the one which often determines its market value is the butter fat. This can be determined readily by the Babcock test.

BOTANY

As the course of study in the College of Agriculture is arranged, Botany is the chief scientific foundation for the practical sciences and arts of Agronomy and Forestry. It is our idea that Agronomy, as a college subject, is the science which treats with plants as industrial crops and sources of income. It follows obviously from such a definition of Agronomy that its chief subject matter consists of plants, and that efficiency in Agronomy is dependent upon an understanding of the nature of plants. The function of our Department of Botany is to give to the students this understanding of plants, and to make this understanding perfect enough to serve as a good foundation for the further study of individual plant crops and of the most effective treatment of these crops.

In the six-year course in this College, every student studies general botany for one year and plant physiology for one year before beginning the technical study of Agronomy. During the work of these two years the material for study is chosen in such a way that it may yield as much concrete information of practical value as is possible. The exhibit of the Department of Botany is intended to give visitors as good an idea as possible of what this preparation for Agronomy really is.

General Botany

The exhibit of the work of the first year in Botany is in the room at present used for the laboratory work of this class, in the Main Building. It is shown by Mr. Espino, with the help of undergraduate assistants. This room was built for an assembly and reading room for the College, and the College has no place where students may gather for study while it remains necessary to use this room for Botany. The exhibits of this class are as follows:

I. **Herbarium Specimens.**—Each student in the class prepares specimens of 75 different plants. These are not usually assigned, but the students are always expected to become acquainted as largely as possible with plants of economic value. The specimens exhibited are for this purpose classified under the following heads:

1. Fruits	4. Weeds	7. Vegetables
2. Flowers	5. Cereals	8. Oils and Condiments
3. Fibers	6. Ornamentals	9. Confections
	10. Mats, Hats, Baskets	

II. **Wall Charts.**—The twenty charts on the walls have been prepared as labor for the College, but by members of this class. Their purpose is to make it easy for the students to understand the structures which are lectured about and then studied under the microscope.

III. **Microscopic Preparation.**—Under the several microscopes in the laboratory are selected objects of study by the class. These have been chosen primarily as objects likely to interest visitors, but at the same time fairly represent the materials studied in the regular work of the class. These objects are as follows:

1. Plant cells from a hair of squash
2. The same cells with the protoplasm contracted
3. Forms of food stored in seeds
4. Cross section of the root of abaca
5. Cross section of the root of coconut
6. Cross section of the stem of maize
7. Cross section of the stem of the sugar cane
8. Cross section of the stem of a rubber vine

9. Cross section of the wood of *dapdap*
10. Cross section of the wood of pine
11. Cross section of narra wood
12. Breathing pore on the stem of papaya
13. Cross section of coffee leaf
14. Cross section of leaf of *Eucalyptus*
15. Breathing pore of leaf of coconut
16. Plant hairs and scales
17. Bacteria from decaying leaf of Mauritius hemp
18. Slime molds
19. Black mold of bread
20. Green mold, growing on leather
21. *Phytophthora* on papaya
22. *Sclerospora* on maize
23. *Nectria* on pod of cacao
24. The coffee rust
25. Section of an edible mushroom
26. Spores of *paco*
27. Section of leaf of *paco*
28. Pollen of *calamismis*
29. Stigma of *calamismis* with pollen grains

IV. **Notebooks of Students.**—The notebooks exhibited are those of this year's class and therefore represent only a little more than half of the year's work.

Plant Physiology

The work of this course is intended to make the students familiar with the behavior of plants and the methods by which this behavior can be controlled. The ability to control crops so as to make them thrifty and productive is the whole object of scientific training for plant industry. The class in Plant Physiology performs more than 70 experiments, all of them chosen for the purpose of making this year's work most valuable for students of practical agriculture. The following 23 experiments are selected from this course as convenient and instructive subjects which will be easily understood by visitors. These are to be found in the plant physiological laboratory in the laboratory building north of the main road. They are exhibited by Dr. F. T. McLean, with the help of student assistants Yap, Collado and Villadolid.

Water Relations

1.—**Measurements of the rate of absorption and transpiration.**

A rice plant is placed with its roots sealed into a jar, so that the only loss of weight is by evaporation from the leaves of the plant. The jar is filled with earth, over which is standing water. Transpiration is measured by weighing plant and pot; absorption is measured by refilling the jar at intervals and thus finding the amount of water removed from the jar.

Object: To find how much the plant is dried out by rapid transpiration. If transpiration exceeds absorption, the difference represents loss of weight by the plant. Drying checks growth and hinders food manufacture.

2.—**Transpiration from sugar cane measured by a recording machine.**

Object: To show the variations in transpiration rate at different times of day.

The plant is sealed into a can, so that the only water loss is through the plant. Plant and pot are mounted on a self-recording balance which makes a continuous record of the weight.

3.—**Cuticular and stomatal transpiration.**

Object: To find out how much water is lost from the upper surface and how much from the under surface of a coconut leaf.

A coating of vaseline is applied to the upper surface of the pinnae of one leaf and to the under surface of the pinnae of another leaf. The stomata

of the coconut are on the under (inner) surfaces, from which most of the transpiration occurs. Stomatal transpiration is regulated by the opening and closing of the stomatal pores; but the plant canot regulate the transpiration from its upper surface.

4.—Water conservation in soils.

Object: To show the effects of mulching and of cultivation upon the amount of water loss from growing beans. The growth and the loss of water from each of four pots of beans is measured. One pot is mulched with rich hulls, one is left undisturbed, a third has the soil kept stirred and a fourth is sealed up.

5.—Absorption, measured by movement of bubble.

Object: To accurately determine the absorption by plant roots for short periods of time.

A bottle in which a growing plant is placed is made airtight, and is arranged so that the water absorbed by the plant is replaced through a slender horizontal glass tube. A small bubble of air is introduced into the tube, to indicate the rate of flow of the water through it.

6.—Effect of soil moisture upon the growth of rice and of maize.

Object: To determine the degree of soil moisture most favorable to these crops.

The plants are grown in cans and watered daily, in order to maintain different amounts of soil moisture in the different cans. The growth and yield of the plants will indicate how much water should be supplied to these crops during dry seasons and whether drainage is necessary on wet lands.

7.—Hydrotropism of roots.

Object: To show how the roots of plants grow toward soil with the most favorable amount of water.

8.—Guttation.

Object: To show that the moisture found on leaves at night is due partly to excretion of liquid from leaves, as well as to dew.

The drops of water clinging to the tips of the rice leaves under the glass jar are caused by secretion from special terminal pores, called *hydathodes.*

9.—Root pressure.

Object: To show how much pressure may be exerted to force water up from the roots to the leaves.

The column of mercury in the U-tube is supported by pressure from the roots. While sufficient to cause guttation when transpiration is at a minimum, this pressure is not sufficient to supply an actively transpiring plant with enough water.

Mineral Fertilizers

10.—Effect of certain mineral foods on the growth of Maize.

Object: To show what mineral elements are necessary for the growth of maize. The roots of the plants are grown in rain-water, to which are added solutions of mineral salts of known quantity and composition. In cultures which lack any essential element the plants soon die. This experiment shows what food elements must be absorbed by plants through their roots.

11.—Effects of mineral fertilizers on the growth and productiveness of garden crops.

A series of small garden plots are fertilized with chemical fertilizers, similar to the salts used in (10). This shows which of the essential elements may be most advantageously applied to garden and "truck" crops. The minerals used are the four most used as farm fertilizers—lime, potash, phosphorus and nitrogen. This experiment is shown in the field, two hundred meters north of the laboratory.

12.—**Effect of stimulants upon the growth of rice.**

Object: To determine the effect of minute quantities of certain metallic poisons on the growth of rice.

Varying amounts of manganese sulphate and of iron sulphate are applied to cultures grown in cans.

GROWTH AND CONDITIONS AFFECTING IT

13.—**Measurement of growth by kathetometer.**

Object: To show the constant variations in rate of growth, apparently caused by internal influences, within the plant.

The elongation of the youngest leaf of a maize plant is measured at short intervals of time by means of a horizontal microscope.

14.—**Effect of light upon the size and texture of tobacco leaves.**

Object: To find what intensity of light is most favorable for growing wrapper tobacco.

Young seedlings of tobacco are placed in different light conditions and their growth and development measured.

15.—**Effect of light on the growth and yield of root crops.**

Object: To show the importance of direct sunlight in the growing of radishes.

16.—**Influence of light on the size and quality of lettuce.**

17.—**Growth measured by auxanometer.**

Object: To show the variations in the rate of growth of a plant at different times of day and night.

A fine cord is attached to the tip of a plant, then passed over a wheel. A pointer at the other end of the cord makes a tracing on a revolving drum, thus indicating the height of the plant at any desired instant. This shows particularly the differences in growth between day and night.

18.—**Effect of temperature on growth of maize.**

Object: To find the optimum temperature for maize seedlings, and also what differences there are in rate of growth at temperatures below and above the optimum.

The seedlings are arranged in a row along a box, in one end of which ice is kept, with warm water in the other end.

19.—**Effect of outdoor climatic conditions on the growth of field crops.**

Object: To find out the effect of rain, wind, sunshine, etc., on the growth of several important field crops.

Measurements are being made by the students of the weekly growth of more than 3,000 plants of different sorts. Careful and complete weather records are kept and the growth of the plants each week is compared to the weather for corresponding periods. The results of some of these comparisons are shown by graphs representing the growth and the different weather observations, plotted on the same sheet of coordinate paper.

20.—**Effect of season of planting and of weather conditions during growth upon the production of rice.**

Object: To find out what conditions of weather are most favorable for rice.

A small plot of rice is planted each 28 days during the year, and records are kept of the growth, time of flowering and ripening, and of the yield of each plot. Thorough weather records are kept from instruments placed in the rice paddy. This experiment is found just back of the laboratory.

21.—**Growth of roots and stem.**

Object: To ascertain whether the same conditions produce rapid growth of both roots and stems of plants.

The growth of the stems of several plants is measured, and at the same

time sample roots are carefully uncovered and inserted into glass tubes, so that their growth can also be measured.

22.—Growth of leaves.

Object: To find the rate of expansion of leaves of different ages.

The leaves of several plants are marked off into squares and the dimensions of each square are recorded daily while growth continues.

23.—Formation of starch in leaves in sunlight.

Object: To show that starch is manufactured in green leaves, and that light is necessary for this.

A leaf is covered with a piece of cardboard in which the student's initials are cut. The plant is then exposed to the sun during a sunny day. The covered leaf is detached, boiled and saoked in alcohol to remove the green color, then soaked in iodine solution. Iodine stains starch blue. Note the initials outlined by the blue stain on the treated leaf. This indicates that starch was formed in the part of the leaf exposed to the sun, but not in the covered part.

Advanced Plant Physiology

A small class of graduate assistants is given a year's course in the physiology of plant nutrition. There are taking this work at present five students, each of whom does the required general work of the class and at the same time investigates a particular phase of the question with which the whole class is concerned. At present, this question is the food which plants take up from the soil in water. This class recites in the dean's office and has no room for its own use. For exhibition purposes, the work of the class is assembled in the Botany I laboratory and will be explained by Mr. Rafael B. Espino. The work exhibited for the several members of the class is as follows:

Mr. Ocfemia: Pot cultures of upland rice, showing the rate of growth as influenced by supplying the plants with nitrogen in the forms of ammonia and nitrate respectively, and the influence of varying amounts upon the rate of growth.

Mr. Marquez: Results of analyses, showing the absorption of various mineral foods by rice grown on open ground.

Mr. Espino: Water cultures of rice, showing the effect of giving the plant ammonium sulphate in varying concentration.

Mr. Vista: Pot cultures of maize, showing the influence upon growth of fertilizers in which the form and amount of nitrogen varies.

Mr. Aldaba: Pot cultures of tobacco, showing the influence of different rates of transpiration and different amounts of fertilizers.

Plant Pathology

Fungus pests are the limiting factors in the raising of many crops. The climatic conditions of the Philippines account for the great number and destructiveness of plant diseases. Every important Philippine crop has known fungus enemies. No estimates have been prepared of the total losses due to plant diseases in the Philippines, but it would be safe to say that at least ten percent of all our crops are destroyed by fungus pests.

The exhibit of College work in Plant Pathology will be in charge of Mr. Otto A. Reinking, Assistant Professor of Plant Pathology, assisted by Simon Reyes, student assistant, and is to be found on the second story of the temporary building. It consists of mounts, showing typical diseases of Philippine crops, accompanied by fresh material

of the most of these diseases, and by microscopic preparations, and pure cultures of some of them. There is also a demonstration of methods of inoculation and its results, of methods of preparing pure cultures and fungicides, and methods by which they are applied. There is also an exhibit of different varieties of coffee, showing their varying degrees of immunity to attack by the coffee rust.

The mounted specimens illustrate the following diseases, listed here alphabetically, according to the name of the organism which causes them:—

Astermella Stuhlmanni, a leaf spot of pine-apple.

Bacillus Solanacearum, the bacterial wilt of tomato.

Bakerophoma Sacchari, a leaf disease of sugar cane.

Cercospora sp., a leaf spot of sugar cane.

Cercospora Henningsii, a leaf spot of cassava or camoting cahoy.

Cercospora lussoniensis, a leaf spot of bean.

Cercospora Mangiferae, a leaf spot of mango.

Cercospora Nicotianae, a leaf spot of tobacco.

Cercospora personata, a leaf spot of peanut.

Cercospora Sesami, a leaf spot of sesame.

Colletotrichum nigrum, the anthracnose of red pepper.

Exosporium darum, a leaf spot of coconut.

Fusarium Theobromae, the fruit rot of cacao.

Helminthosporium Caryopsidum, the grain mould of sorghum.

Helminthosporium curvulum, the tassel mould of corn.

Helminthosporium inconspicuum, a leaf spot of corn.

Hemileia vastatrix, the rust of coffee.

Kuehneola Fici, the rust of mulberry.

Lasiodiplodia Theobromae, the pod disease of cacao.

Macrophoma Musae, a leaf spot of banana.

Melanconium Sacchari, a rind disease of sugar cane.

Micropeltis mucosa, a leaf spot of coffee.

Mycosphaerella Caricae, a leaf spot of papaya.

Mycosphaerella Musae, a leaf spot of banana.

Oospora Oryzetorum, the panicle disease of rice.

Peronospora sp., the downy mildew of soya bean.

Pestalozzia Palmarum, a leaf spot of coconut.

Phyllachora Sorghi, a leaf spot of sorghum.

Phyllosticta Glumarum, a glume spot of rice.

Phyllosticta Hortorum, a fruit spot of egg plant.

Phyllosticta Miurai, a leaf spot of rice.

Phytophthora Colocasiae, the blight of gabi.

Phytophthora Faberi, the black rot of pods of cacao.

Phytophthora Faberi, the fruit rot of papaya.

Pseudomonas Citri, the canker of orange, etc.

Pseudomonas Phaseoli, the bacterial blight of bean.

Puccinia purpurea, the rust of sorghum.

Pythium sp., the damping off of tobacco.

Sclerospora Maydis, the downy mildew of corn.

Sclerotinia sp., the stem rot of coffee.

Uredo Vignae, the rust of cowpea.

Uromyces Sojae, the rust of soya bean.

Ustilagonoidea virens, the smut of rice.

Ustilago Sacchari, the smut of sugar cane.

Ustilago Sorghi, the smut of sorghum.

CHEMISTRY

At most agricultural colleges, chemistry is the essential scientific basis upon which agriculture itself is made to rest. While botany is here given the foremost place as a subsidiary science, the real importance of chemistry is not overlooked. After the two years of essentially preparatory work in the six-year course, or at the beginning of work of the four-year course, all students begin the study of chemistry at the same time that they have first their work in agronomy. All students are required to finish two years of chemistry, and two years of additional elective work are offered. There are at present three classes in chemistry, and the number of students is so great that their proper instruction is much more difficult than it would be with adequate space and equipment. Beside the instruction of the students, the work of the Chemical Laboratory includes investigation of subjects of interest in agricultural chemistry, and the making of many analyses called for by other departments. A large part of the work of a good chemical laboratory lends itself very poorly to exhibition. The following subjects have been selected for demonstration, partly because the results are easily seen, and partly because these results are of great and recognized interest and importance.

Soil Analysis

The methods of physical and chemical analysis of soils will be shown and explained to those interested. While it is recognized that neither the chemical nor physical analysis of a soil can determine its productive power, nor, as is popularly supposed, its adaptability to particular crops, yet for purposes of fertilization and control of soil fertility, and for irrigation, both are of great help to the man who knows how to interpret them. The methods used and the interpretation of the results obtained furnish a part of the subject matter in Chemistry III.

Soil Acidity or Lime Requirement

A comparison of the acidity of various soils of the vicinity, as determined by the different standard methods is being made by the class in Chemistry III, and the methods and apparatus used and results obtained will be exhibited and explained.

Fertilizer Analysis

The soils of the Islands generally are regarded as being very productive, but even the most productive soils, if cropped continously, will become "worn out" unless their fertility is maintained by some proper means. One of these is the use of fertilizers and soil amendments. Others, to be sure, are employed and in many cases their use is to be preferred. Crop rotation, green manuring and stock raising are among the best ways the farmer has for keeping up his soil values. When, for any reasons, these means are not expedient, artificial fertilizers must be employed, and if their use is to be extensive, the so-called "commercial fertilizers" are to be preferred. A knowledge of the constituents of the various fertilizers on the market is, then, of decided advantage to the prospective buyer. Also, since fertilizers may be so easily misbranded, or named in a misleading manner, the need for more intelligent selection of fertilizer becomes apparent. One of the best ways to secure this knowledge of the components of fertilizers and of their values, singly and combined, is by actual analyses of samples of the various brands offered for sale. Practically, this gives the College, or the farmer furnishing the sample, the "analysis" of his fertilizer,

and is a check on the sale of misbranded goods.

A study of the various fertilizers and some of the conditions governing their use, preservation and values is also given in Chemistry III.

The methods of determining the "N-P-K Value," or the amount of nitrogen (nitrate or ammonia), phosphoric acid (phosphate) and potash, will be exhibited and explained.

A study of the rate of absorption of potash and phosphoric acid by rice, when fertilized and unfertilized, will also be explained.

Insecticide Analysis

Methods for determination of copper and arsenic in Paris Green will be shown and explained by Mr. Teodoro, as a part of the work of Chemistry II.

Sugar

Just as the manager is the head, so the sugar chemist is the eye of a sugar central, and today there are no well managed sugar factories without a chemist to control the production of cane sugar. But a "sugar analysis" is not limited in value to the sugar central only; it may be found useful by those farmers who sell sugar cane to the latter. The farmer is in a much better position to know the value of his cane when he has at hand actual determinations of its sugar content. A demonstration of the fundamental operations of cane and sugar analysis will be given by Dr Roxas. This will include polarization of cane juice and of the finished sugar, analysis of bagasse for moisture, sucrose and fiber, and determination of the acidity of the extracted juice. The latter is important in determining the amount of lime needed for classification.

Dioscorea or Ubi

Mr. Leopoldo Clemente is making a chemical study of different varieties of Dioscorea to determine their food values. His work and the results so far obtained will be shown and explained.

Cassava

A study of the relation of starch content to age is being made by Mr. Montellano, Assistant in Chemistry, and will be explained to anyone interested. This work, begun last year, was interrupted by other work, but will probably be completed this season.

Tobacco

The importance of the tobacco crop in the Philippines is well known. Considerable time is being given to a study of the methods of cultivation, curing, etc. The nicotine of the tobacco is at the same time a reason for, and an objection to, its use, and a knowledge of the nicotine content of the tobacco of the different varieties, as affected by the various methods of cultivation and curing, with a view of reducing this constituent without impairing the tobacco flavor and aroma, is much to be desired. One phase of this work, the effect on the nicotine content of different fertilizers, is being studied by Mr. Joaquin J. Gonzales. His results and methods will be explained to the visitors to the laboratory.

Coconuts

Mr. Paul Villyar has conducted an investigation of the methods of production of coconut oil in use in the Islands, as a thesis subject. His methods and results will be exhibited.

Oils

Peanut Oil.—Mr. H. S. Silayan, Student Assistant in Chemistry, is studying the effect of fertilizers on the oil content of the different varieties of peanuts, domestic and foreign. The percentage of oil in each variety, grown under different conditions, is determined

as a basis for selection. Peanut products will also be exhibited, and some of the uses of peanuts as food illustrated.

Lumbang Oil.—A study of the oil content of Lumbang nuts from different trees of the same variety and from trees of different varieties, and of the yield of nuts from different trees is being made by Mr. F. O. Santos, Assistant in Mathematics, as a part of his work in Chemistry. The results of his work to date, the methods of obtaining the oil, and its uses, will be one of the exhibits.

Ipil-Ipil Oil.—Mr. Montellano has made a preliminary study of the oil in ipil-ipil seeds, with a view of determining its commercial value. His results will be shown and explained.

Miscellaneous

Soap Making.—Determination of the amount of alkali (soda) to be used for a given weight of oil will be made and the method of making soap will be illustrated and discussed.

Vinegar.—Determination of the amount of acetic acid in vinegar from different sources will be made and described.

Papaya.—It is traditional in the Philippines and elsewhere that papaya fruit has the property of rendering meat tender when spread over it. Chemists have found that the papaya fruit, and the juice of the plant as well, contain an enzyme which they call "papain." Papain nowadays is a commercial preparation, and has the power of helping in the digestion of meat. A demonstration of the preparation of papain from the papaya fruits and juice, as well as the digestive action of the latter on meat or coagulated egg albumin, will be given.

Essential Oils

An apparatus illustrating the method of obtaining the essential oil from ilang-ilang will be in operation.

Agricultural Engineering

The work of this department consists of the construction of buildings and special machinery for the handling of farm crops, the setting up or assembling of machinery bought, construction and maintenance of roads, and the maintenance and incidental construction of the electric lighting and water systems.

Since the exposition last year, two buildings have been constructed. The Seed and Harvest Laboratory is for the handling of seeds and root crops with which the department of agronomy may be working. This building was constructed at a cost of ₱10,000. The building consists of two rooms each 9.60 by 12.60 meters. The space between the rooms is roofed over, the roof extending forwards at right angles to the building proper, so as to form a shelter under which carts may be unloaded in wet weather; and backwards so as to provide a space under which the seed spread out to dry on the drying floor may be sheltered quickly during showers. The drying floor is 9 by 23 meters.

The Agronomy Building, including the fixtures, was constructed at a cost of ₱30,000, and will for the present provide space for entomology, plant pathology, and part of the agronomy work. The tracing and blue printing of the plans for these two buildings was the work of one of the students in agricultural engineering, who graduated during the past year.

As no special allotment has been made for the construction of farm roads, it has been impossible to construct anything but dirt roads, which are unsatisfactory and difficult to maintain during the rainy season. Such roads as have been constructed have been constructed out of funds allotted for labor, or for buildings where it was necessary to construct some sort of an approach to the building. There are at present about four kilometers of roads to be maintained on the farm, not including roads between experimental plots, and about three kilometers are in need of construction. All should be surfaced with rock, so as to permit hauling over them in wet weather.

There has been constructed a machine for the extraction of starch from *camoteng cahoy*. This machine consists of a revolving grater into which a stream of water plays, so as to separate the starch from the coarse fiber. The starch is then run into troughs or vats where it is washed clean and allowed to settle. This machine is a working model, and was constructed entirely on the grounds, with a very limited number of tools; consequently some of the parts which in a perfected machine might more properly be made of metal are of wood.

In the class room of the engineering class will be placed on exhibit drawings and problems, the work of this year's class in agricultural engineering, and a model house for the breeding of hogs.

The instruction given the class is designed to enable them to design such structures as are necessary on the farm, and to estimate their cost. With this end in view, they are taught the use of graphics as applied to the solution of the forces acting on different structures, for the purpose of determining the kind and strength of materials to be used in the different structures in order to get the most economical results.

Drawing is taught in order to enable them to make definite plans for their operations, whether these be the laying out of a farm for the purpose of rotation of crops and efficiency of management, or the construction of buildings or irrigation structures such as diversion weirs, gates or canals. It is taught also in order that they may be able to read the plans made by engineers, which

they will encounter in the various publications on irrigation and farm machinery.

The model swine house is of the colony type, part of it being left unfinished in order to show the construction as well as the arrangements for feeding and caring for the hogs.

It is built with a half monitor roof which is peculiarly adapted to the two row type of hog house, as it easily admits of lighting and ventilation. While the model shown will consist of four sections of two units each, it will be evident that it may be extended to any desired length, and though it is made to represent a house built of strong materials, it could be very easily modified, and built of the materials to be found in the localities where the construction is to take place.

The students in charge of the exhibit will have plans and estimates of cost, which will be available to these interested. These estimates will be based on three different types of construction: First, using a cement foundation, floor, and feeding troughs, together with wood framing and iron roof; second, using cement floor and troughs, with nipa roof, and *sauale* sides; and third, with a raised dirt floor, wooden feeding troughs, and the rest of the construction, of nipa and bamboo.

Two students are preparing their graduation theses in this department. One subject is the determination of the cost of the construction and maintenance of the different types of fences. Some of the different types considered are to be found at the rear of the physics laboratory. The second is the determination of the strength of bamboo, i. e., its bending moment and crushing strength. As the College has no apratus for this work, it was necessary to improvise it out of the materials on hand.

Department of Entomology and Zoology

This Department is in charge of instruction in general zoology and in economic entomology; but the former course had to be discontinued in the earlier part of the present year because of lack of personnel. An extensive study of the biology of injurious and beneficial insects of the College farm is made by actually breeding the insects through their entire life history and making notes on the duration of instars, and on the forms and habits. A survey of the insect fauna of the neighboring places is made, usually once a week; and in this way, the students obtain first-hand information on the habits and habitats of insects in their natural condition. The control of insects by insecticides and natural enemies will be taken up in the latter part of the year, when the students will have become fairly well acquainted with the subject. Work in sericiculture is given to the students, each member of the class being required to breed a generation of mulberry silkworms through its complete life cycle, and, subsequently, to submit a report embodying observations on the life history, behavior and care of the silkworms.

The main part of the entomological exhibition is in the new Agronomy Building, and is representative of the work of our students.

A display of biological specimens of injurious and beneficial insects, which have been bred, prepared and mounted by the students, is a feature of the exhibition. Whenever practicable, living insects at work accompany the mounted specimens. The following is a partial list:

Leptocorisa acuta, of the rice

Musca domestica, the common house fly

Papilio alphenor, the orange dog

Agromyza destructor, the legume-stalk maggot

Pyrausta vastatrix, the corn and sorghum borer

Oryctes rhinoceros, the "uang"

Rhynchophorus ferrugineus, the Asiatic palm weevil

Laccoptera luzonica, a pest of the camote leaf

Eurydema pulchrum, common hemiptera on garden plants

Nezara viridula

Mixtila pupillalis on *Sapindus saponaria*

Erionota thrax, the banana leaf roller

Chilomenes 6-*maculata*, a beneficial lady beetle feeding on aphids

Helopeltis collaris, of the citrus

Helopeltis bakeri of the cacao

Epilachna 28-*punctata*, of the tomato and of other Solanaceous plants

Plusia eriosoma, of corn

Gnaphalocrocis medinalis, the rice lea roller

Argina cribraria, on Crotalaria retusa

Asarcina aegrota, a predaceous enemy of the aphids

Cylas turcipennis, the camote-tuber weevil

Psylloides balyi, flea beetles of the egg plant

Psylloides splendida, flea beetles of the egg plant

Aulacophora coffeae, a leaf beetle of the cucurbits

Prodenia ornithogalli, of the tobacco and the castor bean

Metriona trivittata, of the camote

Leptoglossus membranaceus, of *amargoso*

Dysdercus cingulatus, of many ornamentals

There will also be a display of alcoholic specimens, to include such materials as the dissected uterus of the pig, foetus of the pig with placenta and umbilical cord; scorpion dissected to show poison glands; scale insects and work, and many others. Microscopes

will contain prepared slides of sections of the human body, parts of insects and of other animals. Slides will be changed at 1:00 p. m. on December 1st, and at 7:00 a. m. and 1:00 p. m. on December 2nd. A space will be allotted to a display of class-work accessories, such as collecting nets, cyanide bottles, insects boxes and pins, pinning blocks, butterfly spreading boards with specimens in the process of preparation, and specimens of students' laboratory notebooks. Materials for the study of comparative osteology, skins of injurious and beneficial Philippine birds and specimens of reptiles will be displayed in glass-faced cabinets.

The eri silkworm (*Attacus ricini*) is not in cultivation in this College but we have adult specimens of the insects and different grades of eri silk, or *seda cruda*, from the Bureau of Science, where this species was formerly cultivated. The specimens are placed in an appropriate display case, with explanatory remarks. The mulberry silkworm (*Bombyx mori*) is cultivated in this College in an especially constructed silkhouse. The display case of this species will consist of mounted adults, eggs, larvae in all instars, pupae and cocoons, together with samples of silk of different grades (from the Bureau of Science) with explanatory remarks. The silk house will be open to the inspection of visitors on the Exposition Day. Here, we have in cultivation two varieties of the mulberry silkworm, the white and the yellow. Both belong to strains which produce *nine* generations a year, in contrast with the two generations in Japan and in certain other countries where sericiculture has been engaged in with success. The yellow variety of the College will be in the pupal stage on the Exposition Days, and will be due to emerge on or about December 4th. The white variety will be in its first larval instar by December 1st, and will go through its first molt on December 2nd.

The insectary is on the south side of the temporary building, and all indoor breeding work of the class is carried on in this place. Living specimens under observation in cages and in battery jars may be seen in this building.

The entomological exhibit is in charge of Mr. Leopoldo B. Uichanco, Assistant in Entomology, assisted by Mr. Arsenio A. Goco and Mr. Leopoldo Clemente, Student Assistants in Entomology, and by the students in Economic Entomology.

General Information

THE COLLEGE OF AGRICULTURE
UNIVERSITY OF THE PHILIPPINES

Established June, 1909

Number of students, 1909—55; 1910—95; 1911—175; 1912—253; 1913—294; 1914—380; 1915—428; 1916—450.

Students have come from 40 provinces.

Total number of alumni—62.

Number of members of faculty—15.

Present value of entire plant—₱240,000.

Present annual support about ₱130,000.

Average present annual cost of operation per student—₱291.

Tuition—free.

Number of students partly or entirely self-supporting over 200.

Student living expense, per month, ₱10 to ₱20.

Area of grounds, 127 hectares.

Number of permanent buildings—11.

Number of work animals—23.

Number of hogs—30.

Number of chickens—120.

Average number of paid laborers employed in farm work—16.

Area in culture—60 hectares.

Number of plants in permanent planting of coconuts, abacá, coffee, fruits, etc.,—about 18,000.

Number of plants, plant cuttings and seed samples distributed through students and otherwise, 1909-1916—about 800,000.

Number of cultures in constant progress, including seed selection, fertilizer tests, etc.,—about 2,500.

Number of pages in publication of original studies, and investigations by faculty, 1909-1916, about 3,500.

Number of pages in publications of original studies, and investigations by students, 1909-1916—1,100.

PRACTICAL WORK
AT
THE COLLEGE OF AGRICULTURE

"The practical training of the farmer is continuous throughout the course, except for the first year of the six-year course. Some of this training is given in other departments, as the use of garden tools in Botany II; the preparation and application of insecticides and the care of pumps in Entomology; and the general repair of implements, making of harrow teeth and plowshares, etc., in Agricultural Engineering. Operations incidental to the culture of particular crops are practiced when these crops are studied, as outlined in the following description of courses. Students are given instruction and practice at various times during the course in:

(a) Farm accounting.

(b) Handling of labor.

Other practical work is distributed through the courses in Agronomy as follows:

Agronomy I: (c) work with hoe, rake, spade, and fork; cleaning of garden paths, drives and walks; preparation of beds. (d) Work with "Planet Junior" hand tools. Credit for (c) and (d) may be obtained in Botany II. (e) Sharpening of all small edged tools. (f) Oiling, cleaning, and care of machine tools, including lawn mowers. (g) Preparation and handling of seed beds; pricking out of young plants in nursery beds and flats; setting out young plants. (h) Plowing, from the use of small plows with single animals to heavy moldboard and disc plows. (i) Machine harrowing, marking, and cultivating. (j) Broadcasting and planting with machine planters. (k) Harvesting and cleaning seed. (l) Management of compost and manure heaps.

Agronomy III (m) Marcottage and making of cuttings and layers. (n) Mixing, and hand and machine application

of fertilizers. (o) Planting young trees and moving older ones. (p) Tree and shrub pruning.

Agronomy IV or V: (q) Budding and grafting, including preparation of wax and tape. (r) Seed grading and selection. (s) Production of inbred, crossbred, and hybrid seeds."—From the Catalogue, University of the Philippines.

PLEASE NOTE

1. All students are given extensive training in all practical details of farm operation and management to the full extent of the facilities furnished by the University.

2. All important culture work on the farm is in the hands of students.

3. Practically all of the student's time outside of academic work is employed on the farm.

4. The thesis work of the advanced students is not purely scientific investigation, but the practical study of simple and pressing problems in Philippine Agriculture. This work constitutes a practical test of the student's ability to apply what he has learned. The highly important practical results of the thesis work are a fully sufficient justification for it.

5. Find one other agricultural college that can show a record of practical work comparable to ours.

THESES PREPARED FOR GRADUATION FROM THE COLLEGE OF AGRICULTURE

PUBLISHED

1. Fertilizer Experiments with Sugar Cane.
2. The Effect of Some Stimulants upon Rice.
3. Fertilizers and the Growth of Rice.
4. The Effect of Shade on the Environment of Abacá and on the Plant Itself.
5. The Influence of N-P-K on the Growth and Production of Corn.
6. The Growth of Maize on Cogon Soil.
7. The Influence of Fertilizer on the Growth and Production of Sugar Cane.
8. The Philippine Chicken.
9. An Economic Study of Beans.
10. Some Experiments on the Growth of Rice in Water-Culture.
11. Lipase in the Germinating Coconut.
12. The Changes Occuring in the Ripening Coconut.
13. The Value of Ipil-ipil as a Soil Renovator.
14. The Efficiency of Leguminous Plants in Increasing the Nitrogen Content of the Soil.
15. Hybridization of Tobacco.
16. Handling and Planting of Seed Cane.
18. Identification and Tests of Varieties of Sweet Potatoes.
19. The Effect of Fertilizers and Stimulants upon the Growth and Production of Corchorus Capsularis L.
20. Cultural Notes on Upland Rice in the Philippines.
21. The Cultivated Root-Producing Aroids.
22. Field Tests of Sweet Potatoes.
23. Improvement of Sesamum.
24. Color Variation in Legumes.
25. Hybridization Corn.
26. Field Tests of Corn.
27. Growth of Legumes as Influenced by Lime.
28. The Influence of Compost Covers on the Conservation of Soil Moisture.
29. Some Experiments in Pineapple Planting.
30. The Cost of Production of Rice by Philippine Methods.
31. Some Tests of Tomatoes.
32. A Study of Nitrification in Philippine Soils.
33. Sugar Manufacture at the Calamba Sugar Estate.

34. Chemical Changes in the Ripening Sugar Cane.

35. Chemical Changes in the Ripening Coconut.

36. Study of Philippine Carabao.

37. Adaptability of Certain Philippine Plants to Propagation by Cuttings and Marcottage.

38. A Study of Native Coffee Production.

39. Cacao and its Local Diseases.

40. Botanical Study of Banana Varieties.

41. Abaca Fiber.

42. Cowpea Culture with Special Reference to Selection Work with the "New Era" Variety.

44. A Study of the Production of Peanuts.

53. A Study of the Effects of Commercial Fertilizers on Corn.

51. Comparative Studies on Half-Breed or "Mestizo" and Native Chickens.

50. A Study of Mushroom Culture in the Philippines.

54. Effect of Girdling on Parang and Forest Trees.

52. Growth Records of the Different Species of Rubber on the College of Agriculture Farm.

55. The Production of Cigar Wrapper Tobacco under Shade in the Philippines.

56. Fertilizer Tests with Tobacco Varieties on College Soils.

57. Variability of Tobacco in Cultures on the College Farm.

61. Fertilization of Rice.

64. Tests and Selections of Mungo Beans.

AWAITING PUBLICATION

A Test of Some Forage Plants.

Acclimatization of Garden Peas.

Field Production of Yautias, Taros and Dasheens.

Cross Breeding of Corn.

Some Experiments with Native Corn.

Working Plan for the Management of the Kaliraya Block, Northern Laguna Forest.

Structural Characteristics of Sixty-Six Rice Varieties.

Bast Fibers in the Philippines (For Master's Degree).

A preliminary Study of Forage Plants (for Master's Degree).

A Study of Cucurbitaceous Vegetables in the Philippines.

Experiments of the Effect of Certain Philippine Feeds on the Growth and Production of Eggs and Meat by Poultry.

Observation on Coconut Seeldings.

Forms of Some Philippine Fruits.

A Study of the Culture of Cruciferous Vegetables of the Philippines.

Acclimatization of Irish Potato.

THESES IN PROGRESS

1. Yautia and Gabi Tests on New Soils.

2. The Minimum Bordeaux Application for Control of Hemileia.

3. Planting of Corn and Legumes Together.

4. Coffee Growth Records.

5. Insect Pests of Tobacco.

6. Seasonal Corn Selections with Ear-to-Row Tests.

7. Nursery Methods with Cacao.

8. A Series of Rotations, with and without Legumes.

9. Performance of Selections of Best local Upland Rices under Fertilization.

10. Selection of some Standard Ilocano and Tagalog Paddy Rices.

11. Selection of Standard Iloilo Rices.

12. Field Fertilization Tests with Tobacco.

13. Individual Types of Native Citrus Varieties as a Basis for Bud Selection.

14. Starch Content and Cooking and Eating Qualities of Dioscorea.

15. The Legume-Root Maggot (*Agromyza destructor*).

16. Betel-leaf in the Philippines.

17. Cropping of Upland Rice by vaca labor only.

18. Culture Tests of Dioscoreas.

19. Composts of Native Locally Produced Materials.

20. Oil Contents of Peanuts as Affected by Fertilizers.

21. Acclimatization Effects with Field Corn.

22. Efficiency of Native Coconut Oil Press Methods.

23. A Study of Economic Philippine Palms.

24. Selection of Soy Beans.

25. Comparative Food Values of Dioscoreas.

26. Chemical Studies of Philippine Rices.

27. Nicotine Content of Tobacco as Affected by Fertilizers.

28. A Study of the Increase of Nitrogen in Soils by Legumes.

MASTER'S THESES IN PROGRESS

29. Spacing, Fertilizer and Variety Tests with Sugar Cane.

30. Acclimatization of Garden Legumes.

31. The Philippine Farmer's Interest Rates.

32. Problems in the Culture of Abacá.

33. Studies of Philippine Plant Galls Caused by Insects.

Besides the Theses for graduation, other papers have been published by students, making the total number prepared about seventy.

The Graduates of the College of Agriculture

CLASS OF 1911

Names	*Employment*
BACHELOR OF SCIENCE IN AGRICULTURE	
Manuel L. Roxas	Instructor in Chemistry, College of Agriculture, U. P.
BACHELORS OF AGRICULTURE	
Clodoaldo Tempongko	Deceased.
José Zamora	Bureau of Agriculture.

CLASS OF 1912

BACHELOR OF SCIENCE IN AGRICULTURE	
Vicente Allarey	Bureau of Agriculture.
BACHELORS OF AGRICULTURE	
Silvestre Asunción	Bureau of Agriculture.
Felipe Cevallos	Principal, Guinobatan Farm School.
Andrés Navarro	Student, College of Medicine and Surgery.
Toribio Vibar	Supervising Teacher, District No. 5, Albay.

CLASS OF 1913

MASTER OF SCIENCE	
Manuel L. Roxas	(Supra).
BACHELOR OF SCIENCE IN AGRICULTURE	
Edgar M. Ledyard	Director, Agricultural Department, U. S. Smelting Co.
Marcelo Crisóstomo	Bureau of Agriculture.
BACHELORS OF AGRICULTURE	
Sotero F. Albano	Teacher, Dingras, Ilocos Sur.
Florencio G. Bagui	Teacher, Batangas High School.
Vicente G. Bartolomé	Bureau of Agriculture.
Bienvenido M. Gonzalez	Instructor in Animal Husbandry, College of Agriculture, U. P.
Antonio Lejano	Farmer, Lumbang, Laguna.
Apolonio R. Muñoz	Teacher, Juban, Sorsogon.
Valente E. Villegas	Bureau of Agriculture.

CLASS OF 914

BACHELOR OF SCIENCE IN AGRICULTURE	
Nemesio B. Mendiola	U. P. Fellow in Agronomy, Cornell University, U. S. A.
BACHELORS OF AGRICULTURE	
Alfredo P. Adriano	Teacher, Bureau of Education.
José S. Camus	Bureau of Agriculture.
Francisco G. Galang	Bureau of Agriculture.
Amando L. Laparan	Bureau of Agriculture.
Gonzalo F. Merino	Farmer, Palawan.
Francisco A. Quisumbing	Assistant in Chemistry, College of Liberal Arts, U. P.
Eladio Sablan	Teacher, Central Luzon Agricultural School.
José P. Tirona	Student, College of Medicine and Surgery, U. P.
Eutiquio Q. Zulaybar	Bureau of Agriculture.

CLASS OF 1915

BACHELORS OF SCIENCE IN AGRICULTURE	
Vicente C. Aldaba	Assistant in Mathematics, College of Agriculture, U. P.
Catalino Geo. Aurelio	Teacher, Capiz High School.
José Q. Dacanay	Assistant in German, College of Agriculture, U. P.
José J. Mirasol	Assistant in Agronomy, College of Agriculture, U. P.
Leopoldo B. Uichanco	Assistant in Entomology, College of Agriculture, U. P.
BACHELORS OF SCIENCE IN FORESTRY	
Antonio P. Racelis	Student in Forestry, University of Michigan, U. S. A.
Aniceto Villamil	Forester, Sandakan, Borneo.
BACHELORS OF AGRICULTURE	
Severo M. Capistrano	Bureau of Agriculture.
Agripino Constantino	Teacher, Mailag Farm School, Mindanao.
Rafael B. Espino	Assistant in Botany, College of Agriculture, U. P.
Teodorico G. Ghofulpo	Bureau of Education.
Segundo D. Labayen	Student, Sugar School, University of Louisiana, U. S. A.
Francisco D. Marquez	Assistant in Agronomy, College of Agriculture, U. P.
José C. Miraflores	Farmer, Victorias, Occidental Negros.

Pedro L. Montellano.....Assistant in Chemistry, College of Agriculture, U. P.
Gerardo O. Ocfemia.....Assistant in Agronomy, College of Agriculture, U. P.
Francisco P. Octubre.....Bureau of Education.
Elias H. Pañganiban.....Farmer.
Roman O. Sarmiento.....Farmer.
Blas C. Velez.....Manager, Hacienda del Rosario.
Arsenio S. Vicencio.....Bureau of Agriculture.
Tomás I. Vista.....Assistant in Agronomy, College of Agriculture, U. P.

CLASS OF 1916

MASTERS OF SCIENCE

Inocencio Elayda.....Instructor in Agronomy, College of Agriculture, U. P.
Nemesio B. Mendiola.....(Supra).

BACHELOR OF SCIENCE IN AGRICULTURE

Domingo B. Paguirigan.....Bureau of Agriculture.

BACHELORS OF AGRICULTURE

Florentino F. Cruz.....Bureau of Agriculture.
José de Leon.....Nurseryman, Department of Mindanao and Sulu.
Vicente M. Dawis.....Superintendent of Coconut Plantation, Calamba Sugar Estate.
Lucio A. San Miguel.....Bureau of Agriculture.
Alfonzo B. Cagurangan.....Bureau of Agriculture.
Cornelio R. Balangue.....Bureau of Education.
Marcelino Constantino.....Bureau of Agriculture.
Pantaleon U. Bacomo.....Bureau of Agriculture.
Gaudencio Palafox.....Bureau of Education.

NOTE THESE FACTS

1. The work described in this number has been done by 103 young Filipinos. It has trained and tested them for agricultural research; as a result, 14 of them have been selected for further work of this kind.

2. These theses exceed in scope and volume all experimental scientific work published by Filipinos in all other sciences and offices combined.

3. The theses are prepared and PUBLISHED *without government expense for the purpose.*

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